374 McArthur Avenue, Ottawa
Assessment of Adequacy of Public Services

Project # CW-01-20

Prepared for:

Castle Heights Residences

By:

Arch-Nova Design Inc.

December 2020

Table of Contents

1. Introduction

The subject property is located at 374 McArthur Avenue, Ottawa. The proposed work comprises of a 6-storey+basement apartment building with total of 67 apartments and amenities on the ground floor. For the purpose of this report the site is considered to run north-south. McArthur Avenue is extending east-west.

Currently the property is used as a residential lot with a single house and it is scheduled for demolition. The rest of the lot is a backyard on the south and west of the property and a driveway along the house's west side. Adjacent properties on the east and west are condominium building. South side (backyard) is adjacent to backyards of houses along Brant Street.

The area is serviced by municipal water (400 mm, 300 mm sanitary sewer and 525 mm storm sewer. The sidewalk in front of the property is at elevation between 60.98 and 61.06 m. a.s.l.

374 McArthur Avenue, Ottawa: Location

2. Public Services Capacity

This section of the report will analyze existing municipal services and the potential impact of the proposed building at 374 McArthur Avenue on the existing service capacity.

2.1 Water Supply

Existing building is supplied from 400 mm pipe and calculate consumption is 0.16 l/sec for the peak period.

Fire hydrant is located at intersection of McArthur Avenue and Brandt Street at distance of 44.1 m, which is sufficient for use of this hydrant by fire department and its vehicles. This hydrant provides fire protection for the site.

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	280 L/d/P
Residential Maximum Daily Demand	9.5 x Average Daily *
Residential Maximum Hourly	1.5 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
During Peak Hourly Demand operating pressure must remain within	275kPa and 552kPa
During fire flow operating pressure must not drop below	140kPa
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

Table 1: Water Supply Design Criteria

[1]The following are boundary conditions, HGL, for hydraulic analysis at 374 McArthur Avenue (zone 1W) assumed to be connected to the 400 mm on McArthur Avenue.

[1] City of Ottawa boundary condition information is based on current operation of the city water distribution system (also see Appendix A for complete correspondence information)

Minimum HGL = 107.8 m

Maximum HGL = 118.5 m; The maximum pressure is estimated to be more than 80 psi.[2]

Max Day (4.32 L/s) + Fire Flow (383 L/s) = 108.0 m, the estimated ground elevation is 59.2 m.

The consumption is expected to be **388.75 l/min (6.48 L/sec)** for peak period. The fire flow for was estimated to be 23,000 l/min (383 l/sec)[3]. The City staff confirmed the required flow availability. With fire hydrant at distance of 44.1 m and available fire flow, the proposed building will be sufficiently protected from fire.

Table 1 presents the City of Ottawa design criteria based on MOE Guidelines.

[2] City of Ottawa: boundary conditions 12.05.2020
[3] OBC SectionA.3.2.5.7, Table 2.

2.2 Sanitary Sewer

Sanitary sewer outflow for the current building is 0.06 l/sec (wet weather peak flow). The lateral is connected to sanitary sewer 300 mm.

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	280 L/cap/day
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Correction Factor (City of Ottawa Tech.Bulletin ISTB-2018-01)	0.8
Commercial Space	28,000 L/ha/day
Infiltration and Inflow Allowance	0.33L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	Q =(1/n)AR2/3S1/2
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2012 & Infrastructure Technical Bulletins 2018	

Table 2: Wastewater Design Criteria

The estimated outflow for the new building is **1.21 l/sec** (peak flow + wet weather).

Existing municipal sewer 300 mm has a capacity of 18.35 l/sec for 0.8% slope and 30% full. For increase of 1.15 l/sec the increase will be 6%. The capacity at 80% full is 91.6 l/sec.

Detailed calculation of pre and post development flow is presented in Appendix A.

2.3 Site Stormwater Services

Current building and the rest of surface of the lot at 374 McArthur Avenue represent a typical urban site. All stormwater runoff is under uncontrolled condition. For the purpose of protecting the municipal

sewer system the City of Ottawa requires that the predevelopment 2-year runoff coefficient should be in range of C=0.5 so the newly developed site must store certain amount of water.

The proposed new building and area of the lot will increase the runoff from 0.5 to 0.75 and this will require the stormwater retention on site in order to match the predevelopment runoff condition.

Proposed stormwater retention will prevent increase of stormwater inflow into the system. Detailed calculation is provided in Appendix A. The stormwater storage is proposed on the new building's flat roof. Total storage required for the 100 year event is 20.89 m^3.

The foundation drain (weeping tiles) is connected to the lateral over back flow prevention valve as well as to the sump pump in the basement which will pump water out to surface and further to street catch basins. The reason for this solution is in the stormwater pipe susceptible to surcharge at events like 2-year storm. Also the underground garage will be regularly washed as well as the access ramp may become a point where surface water can enter inside the building.

Backyard is proposed to be drained through the roof catch basin installed into the ceiling of the underground garage beneath the entire backyard. A lateral (200 mm) should be installed under the ceiling of the garage from the backyard to the front and then connected to the lateral. Two roof drains will be connected through inside of the building to the lateral. t Both roof drains will provide maximum of 2.80 l/sec each and will be a single point for controlled outflow.

3. Conclusion and Recommendation

3.1 Water Supply

The water supply demand calculation is based on the fire flow requirement for residential buildings; it is 23,000 l/min (383 l/sec). The City provided information that required flow is available at 107.8 m of HGL. The building roof is at elevation of 83.2 m which leaves 24.0 psi of residual pressure at maximum HGL of pressure.

3.2 Sanitary Sewer

Existing municipal sewer 300 mm has a capacity of 18.35 l/sec for 0.8% slope and 30% full. For increase of 1.15 l/sec the increase will be 6%. The capacity at 80% full is 91.6 l/sec.

Addition of new building should not overcharge existing system.

3.3 Stormwater

Currently most of runoff is directed toward the street and catch basins. The proposed grading plan directs all runoff toward the street. The proposed new building and area will store excess of water in order match the predevelopment runoff.

The new development will not increase the runoff from the site so there will be on impact on the receiving system.

The City's engineers informed the consultant that the storm system along McArthur Avenue experiences a surcharge at even 2-year events so a recommendation is to install a back flow prevention valve on the stormwater lateral as well as the sump pump at the lower level of the underground garage.

In conclusion, existing municipal water, sanitary and storm services have sufficient capacity to provide water and collect sanitary and storm water from the new development.

Prepared by:

Zoran Mrdja, P.Eng.

December 2020

Professional Engineers Ontario

Authorized by Professional Engineers of Ontario to provide professional services to public

Appendix A: Calculations

Water Supply Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	280 L/d/P
Residential Maximum Daily Demand	9.5 x Average Daily *
Residential Maximum Hourly	1.5 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

374 McArthur Avenue, Ottawa
New

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4		0
Semi-detached	2.7		0
Townhouse	2.7		0
Apartment			0
Bachelor	1.4		0
1 Bedroom	1.4	22	31
2 Bedroom	2.1	30	63
3 Bedroom	3.1	15	47
4 Bedroom	4.2		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	140	39.28	27.28	373.20	259.17	559.80	388.75

Institutional / Commercial / Industrial Demand

				Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**		**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5	$L/m^2/d$	163	0.41	0.28	0.61	0.42	1.10	0.76
Office	75.0	$L/9.3m^2/d$	0	0.00	0.00	0.00	0.00	0.00	0.00
Restaurant*	125.0	L/seat/d							
Industrial -Light	35,000.0	L/gross ha/d							
Industrial -Heavy	55,000.0	L/gross ha/d							
Total I/C/I Demand				0.41	0.28	0.61	0.42	1.10	0.76

Total Demand	39.69	27.56	373.81	259.59	560.90	389.51

* Estimated number of seats at 1seat per $9.3m^2$

Water Demand and Boundary Conditions

Proposed Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (m)
Average Daily Demand	27.56	*
Max Day + Fire Flow	23,259.17	*
Peak Hour	389.51	*

[1)] Water demand calculation per Water Supply Guidelines. See Appendix B for detailed calculations.

[2)] Boundary conditions supplied by the City of Ottawa. See Appendix B for correspondence with the City.

* City to provide

Wastewater Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	280 L/cap/day
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Correction Factor (City of Ottawa Tech.Bulletin ISTB-2018-0	0.8
Commercial Space	28,000 L/ha/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2012.	

374 McArthur Avenue, Ottawa
New

Sanitary Sewer Post Development Outflow

Site Area	**0.1171 ha**
Extraneous Flow Allowances	
Infiltration / Inflow	**0.03864 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	**Pop**
Single Family	3.4		0
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7		0
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4	22	30.8
2 Bedroom	2.1	30	63
3 Bedroom	3.1	15	46.5
4 Bedroom	4.2		0
Total Population			**140**
Average Domestic Flow			**0.45 L/s**
Peaking Factor			**4.1**
Peak Domestic Flow			**1.86 L/s**

Institutional / Commercial / Industrial Contributions

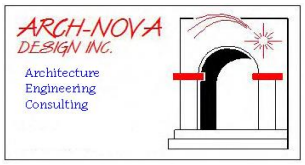
Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial	28,000 L/gross ha/d	0.0163	0.01
Institutional	28,000 L/gross ha/d	0	0.00
Industrial - Light	35,000 L/gross ha/d	0	0.00
Industrial - Heavy	55,000 L/gross ha/d	0	0.00
Average I/C/I Flow			**0.01**
Peak Institutional / Commercial Flow*			**0.01**
Peak Industrial Flow**			**0.00**
Peak I/C/I Flow			**0.0053**

Total Estimated Average Dry Weather Flow Rate	**0.46**
Total Estimated Peak Dry Weather Flow Rate	**1.87**
Total Estimated Peak Wet Weather Flow Rate	**1.91**

Ottawa TechBulletin ISTB-2018-01 Section 4.4.1 Page 4.5
**Use Apendix 4B diagram

Fire Flow Calculation Ontario Building Code 2006 (Appendix A)

Project: 374 McArthur Avenue, Ottawa



Date: **December 23, 2020**
Data input by: Zoran Mrdja, P.Eng.

Type of Construction	Building Clasification	Water Supply Coefficient (K)
Non-combustable construction, or a heavy timber conforming to article 3.1.4.6	A-2; B1-; B-2; B-3 C; D	16

		Total Building Volume (V)(m3)
Building Height (incl.Basement)	28.40	26,135.42
Building Width	18.53	
Building Length	49.67	

Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coefficient S_{tot}*
North	46.00	0	1.5
East	2.50	0.5	
South	50.00	0	
West	12.00	0	

Total Volume of Water Required Q**	**627,250.11**
Minimum Required Fire Flow (L/min) ***	**20,908.34**
Minimum Required Fire Flow (L/sec)	**348.5**

Note:

* S_{tot}= 1+(S_{side1}+S_{side2}+S_{side3}+S_{side4})

** $V=KVS_{tot}$

*** Flow=Q/30 (min) for min. duration of 30 min

Summary:
1. City of Ottawa: available flow_____) ***
2. Nearest fire hydrant distance _____ m;

374 McArthur Avenue, Ottawa
New

FUS Fire Flow Calculations

Project: 374 McArthur Avenue, Ottawa

Calculations Based on 1999 Publication "Water Supply for Public

Fire Protection " by Fire Underwriters' Survey (FUS)

Fire Flow Calculation #: 1

Date: December 23, 2020 Building Type/Description/Name: Apartment building

Data input by: Zoran Mrdja, P.Eng.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.50	Ordinary Construction	1.00		
			Ordinary construction	1.00				
			Non-combustible construction	0.80				
			Fire resistive construction (< 2 hrs)	0.70				
			Fire resistive construction (> 2 hrs)	0.60				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, ind)	1	Units	
			Townhouse - indicate # of units	1				
			Other (Comm, Ind, etc.)	1				
2.2	# of Storeys	Number of Floors/ Storeys in the Unit (do not include basement):			6	6	Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only :						
		Measurement Units	Square Feet (ft2)	0.000	Square Metres (m2)	5995	Area in Square Meters (m2)	
			Square Metres (m2)	821				
			Hectares (ha)	0				
4	Obtain Required Fire Flow without Reductions	Required Fire Flow(without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						17,034
5	Apply Factors Affecting Burning	Reductions/Increases Due to Factors Affecting Burning						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	-2,555
			Limited combustible	-0.15				
			Combustible	0.00				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	0.30	Complete Automatic Sprinkler Protection	0.00	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	30.1-45 m	0.05	0.50	m	8,517
			East Side	0-3 m	0.25			
			South Side	30.1-45 m	0.05			
			West Side	10.1-20 m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:						23,000
		Total Required Fire Flow (above) in L/s:						383
		Required Duration of Fire Flow (hrs)						2.00
		Required Volume of Fire Flow (m^3)						2760

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline

Legend	
	Drop down menu - choose option, or enter value.
	No Information, No input required.

Note:

The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline.

Project Number: CW-01-20 374 McArthur Ave., Ottawa

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PRE-DEVELOPMENT

The pre-development time of concentration is 10 minutes

where:

$I_2 =$ 732.951 / (Tc + 6.199) $^{0.810}$ $I_{100} =$ 1735.688 / (Tc + 6.014) $^{0.820}$

$I_2 =$ **76.8 mm/hr** $I_{100} =$ **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Site	**A1**	0.11720	100.0%	0.50	0.059
TOTAL		0.1172	100.0%		0.059
Weighted C =					0.50

C=0.5 used for predevelopment calculation (City of Ottawa requirement)

$Q_{2pre} = (2.78)*(C)*(I_5)*(A)$

$Q_{2pre} =$ 2.78 x 0.50 x 76.8 x 0.1172

$Q_{2pre} =$ 12.51 L/s

$Q_{100pre} = (2.78)*(C)*(I_{100})*(A)$

$Q_{100pre} =$ 2.78 x 0.63 x 178.6 x 0.1172

$Q_{100pre} =$ 36.37 L/s

POST-DEVELOPMENT (UNCONTROLLED RUNOFF)

The post-development time of concentration is 10 minutes

where:

$I_2 =$ 732.951 / (Tc + 6.199) $^{0.810}$ $I_{100} =$ 1735.688 / (Tc + 6.014) $^{0.820}$

$I_2 =$ **76.8 mm/hr** $I_{100} =$ **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Landscape	**A1**	0.0463	100.0%	0.70	0.032
TOTAL		0.0463	100.0%		0.032
Weighted C =					0.70

$Q_{2post} = (2.78)*(C)*(I_5)*(A)$

$Q_{2post} =$ 2.78 x 0.70 x 76.8 x 0.0463

$Q_{2post} =$ 6.91 L/s

$Q_{100post} = (2.78)*(C)*(I_{100})*(A)$

$Q_{100post} =$ 2.78 x 0.70 x 178.6 x 0.0463

$Q_{100post} =$ 16.08 L/s

Project Number: CW-01-20 374 McArthur Ave., Ottawa

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PRE-DEVELOPMENT

The pre-development time of concentration is 10 minutes

where:

$I_2 =$ 732.951 / (Tc + 6.199) $^{0.810}$ $I_{100} =$ 1735.688 / (Tc + 6.014) $^{0.820}$

$I_2 =$ **76.8 mm/hr** $I_{100} =$ **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Site	A1	0.00000	0.0%	0.95	0.000
			0.0%	0.95	0.000
			0.0%	0.70	0.000
TOTAL		0.0000	0.0%		0.000
Weighted C =					0.50

$Q_{2pre} = (2.78)*(C)*(I_2)*(A)$

$Q_{2pre} =$ 2.78 x 0.50 x 76.8 x 0.0000

$Q_{2pre} =$ 0.00 L/s

$Q_{100pre} = (2.78)*(C)*(I_{100})*(A)$

$Q_{100pre} =$ 2.78 x 0.50 x 178.6 x 0.0000

$Q_{100pre} =$ 0.00 L/s

C=0.6 used for predevelopment calculation (City of Ottawa requirement)

POST-DEVELOPMENT (CONTROLLED RUNOFF)

The post-development time of concentration is 10 minutes

where:

$I_2 =$ 732.951 / (Tc + 6.199) $^{0.810}$ $I_{100} =$ 1735.688 / (Tc + 6.014) $^{0.820}$

$I_2 =$ **76.8 mm/hr** $I_{100} =$ **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Building	A2	0.0709	100.0%	0.95	0.067
TOTAL		0.07095	0.0%		0.067
Weighted C =					0.95

$Q_{2post} = (2.78)*(C)*(I_2)*(A)$

$Q_{2post} =$ 2.78 x 0.95 x 76.8 x 0.0709

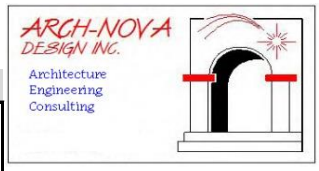
$Q_{2post} =$ 14.39 L/s

$Q_{100post} = (2.78)*(C)*(I_{100})*(A)$

$Q_{100post} =$ 2.78 x 0.95 x 178.6 x 0.0709

$Q_{100post} =$ 33.46 L/s

ALLOWABLE RUNOFF



Predevelopment Runoff:		
Uncontrolled Runoff		
2-year	12.51	l/sec
100-year	36.37	l/sec
Controlled Runoff:		
2-year	0.00	l/sec
100-year	0.00	l/sec

Postdevelopment Runoff:		
Uncontrolled Runoff		
2-year	6.91	l/sec
100-year	16.08	l/sec
Controlled Runoff:		
2-year	14.39	l/sec
100-year	33.46	l/sec

Controlled allowable runoff		
Controlled Runoff:		
2-year	**5.60**	**l/sec**

Comment:

Storage Volumes (2-Year Storm)

Project: 384 Frank St.

Tc = 10 (mins)
C_{AVG} = 0.95 (dimmensionless)
Area = 0.0709 (hectares)
Storm = 2 (year)
Release Rate = 5.60 (L/sec)
Time Interval = 10 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	148	2.8	5.60		
11	73	13.7	5.60	8.11	5.35
21	50	9.5	5.60	3.86	4.86
31	39	7.3	5.60	1.74	3.24
41	32	6.1	5.60	0.45	1.12
51	28	5.2	5.60	-0.42	-1.28
61	24	4.5	5.60	-1.05	-3.85
71	22	4.1	5.60	-1.54	-6.54
81	20	3.7	5.60	-1.92	-9.32
91	18	3.4	5.60	-2.23	-12.16
101	17	3.1	5.60	-2.48	-15.06
111	15	2.9	5.60	-2.70	-17.99
121	14	2.7	5.60	-2.89	-20.96
131	14	2.5	5.60	-3.05	-23.96
141	13	2.4	5.60	-3.19	-26.99
151	12	2.3	5.60	-3.31	-30.03
161	12	2.2	5.60	-3.43	-33.09
171	11	2.1	5.60	-3.53	-36.17
181	11	2.0	5.60	-3.62	-39.27
191	10	1.9	5.60	-3.70	-42.38
201	10	1.8	5.60	-3.77	-45.50
211	9	1.8	5.60	-3.84	-48.62
221	9	1.7	5.60	-3.90	-51.76
231	9	1.6	5.60	-3.96	-54.91
241	8	1.6	5.60	-4.02	-58.07
251	8	1.5	5.60	-4.07	-61.23
261	8	1.5	5.60	-4.11	-64.40
271	7.7	1.4	5.60	-4.16	-67.58

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 732.951 / (Tc + 6.199)^0.810 (2 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

Storage Volumes (100-Year Storm)

Tc = 10 (mins)
C_{AVG} = 0.95 (dimmensionless)
Area = 0.0709 (hectares)
Storm = 100 (year)
Release Rate = 5.60 (L/sec)
Time Interval = 10 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	351	6.6	5.60		
11	170	31.8	5.60	26.24	17.32
21	116	21.8	5.60	16.19	20.40
31	90	16.8	5.60	11.23	20.89
41	74	13.8	5.60	8.24	20.26
51	63	11.8	5.60	6.21	19.01
61	55	10.3	5.60	4.75	17.37
71	49	9.2	5.60	3.63	15.47
81	45	8.4	5.60	2.75	13.37
91	41	7.6	5.60	2.04	11.13
101	38	7.0	5.60	1.45	8.78
111	35	6.5	5.60	0.95	6.33
121	33	6.1	5.60	0.53	3.81
131	31	5.8	5.60	0.16	1.23
141	29	5.4	5.60	-0.17	-1.41
151	27	5.1	5.60	-0.45	-4.10
161	26	4.9	5.60	-0.71	-6.82
171	25	4.7	5.60	-0.93	-9.58
181	24	4.5	5.60	-1.14	-12.38
191	23	4.3	5.60	-1.33	-15.20
201	22	4.1	5.60	-1.50	-18.04
211	21	3.9	5.60	-1.65	-20.91
221	20	3.8	5.60	-1.79	-23.80
231	20	3.7	5.60	-1.93	-26.71
241	19	3.5	5.60	-2.05	-29.63
251	18	3.4	5.60	-2.16	-32.57
261	18	3.3	5.60	-2.27	-35.53
271	17	3.2	5.60	-2.37	-38.50

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 1735.688 / (Tc + 6.014)^0.820 (100 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

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Storage Requirements

2-year **5.35 m^3**

100-year **20.89 m^3**

Surface Type	ID	Area (m^2)	Percent of total Area	Required Storage 2 year	Required Storage 100 year	Max Allowed Drain Outflow l/s	Max Allowed Drain Outflow GPM
Roof	**D1**	284.50	50.0%	2.68	10.45	2.80	44.37
Roof	**D2**	284.50	50.0%	2.68	10.45	2.80	44.37
TOTAL		569.00	100.0%	5.35	20.89	5.60	88.74

Stage-Storage

Roof (Drain D1 & D2)		
Depth m	**Area** m^2	**Volume** m^3
0.050	100.0	1.67
0.075	**215.0**	**5.38**
0.08	**450.0**	**12.00**
0.1105	**569.0**	**20.96**

Legend:
data for 2-year event
data for 100-year event

.

Notes:

Roof drains with controlled flow to be specified by manufacturer using the allowable flow rates presented in this chart

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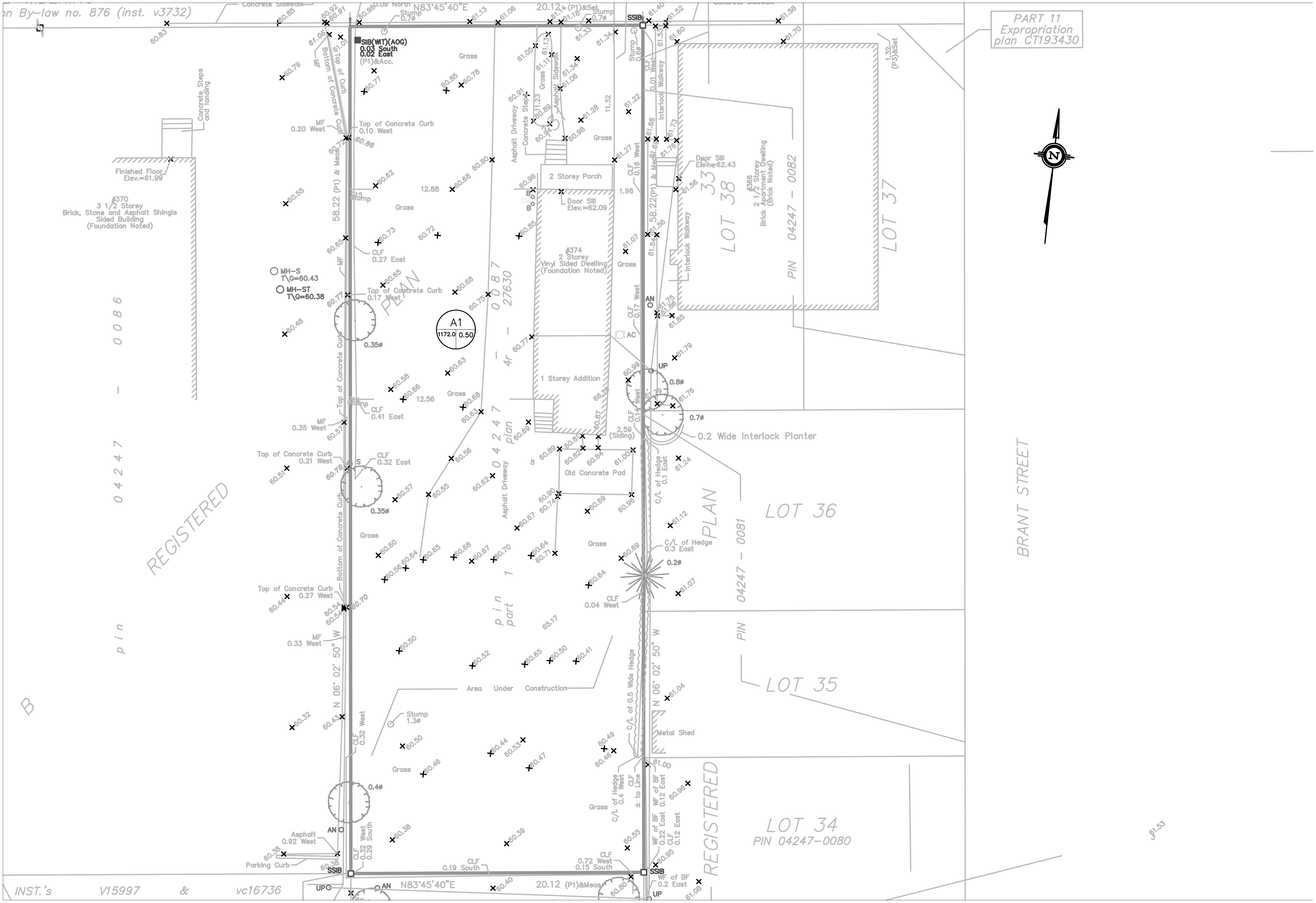
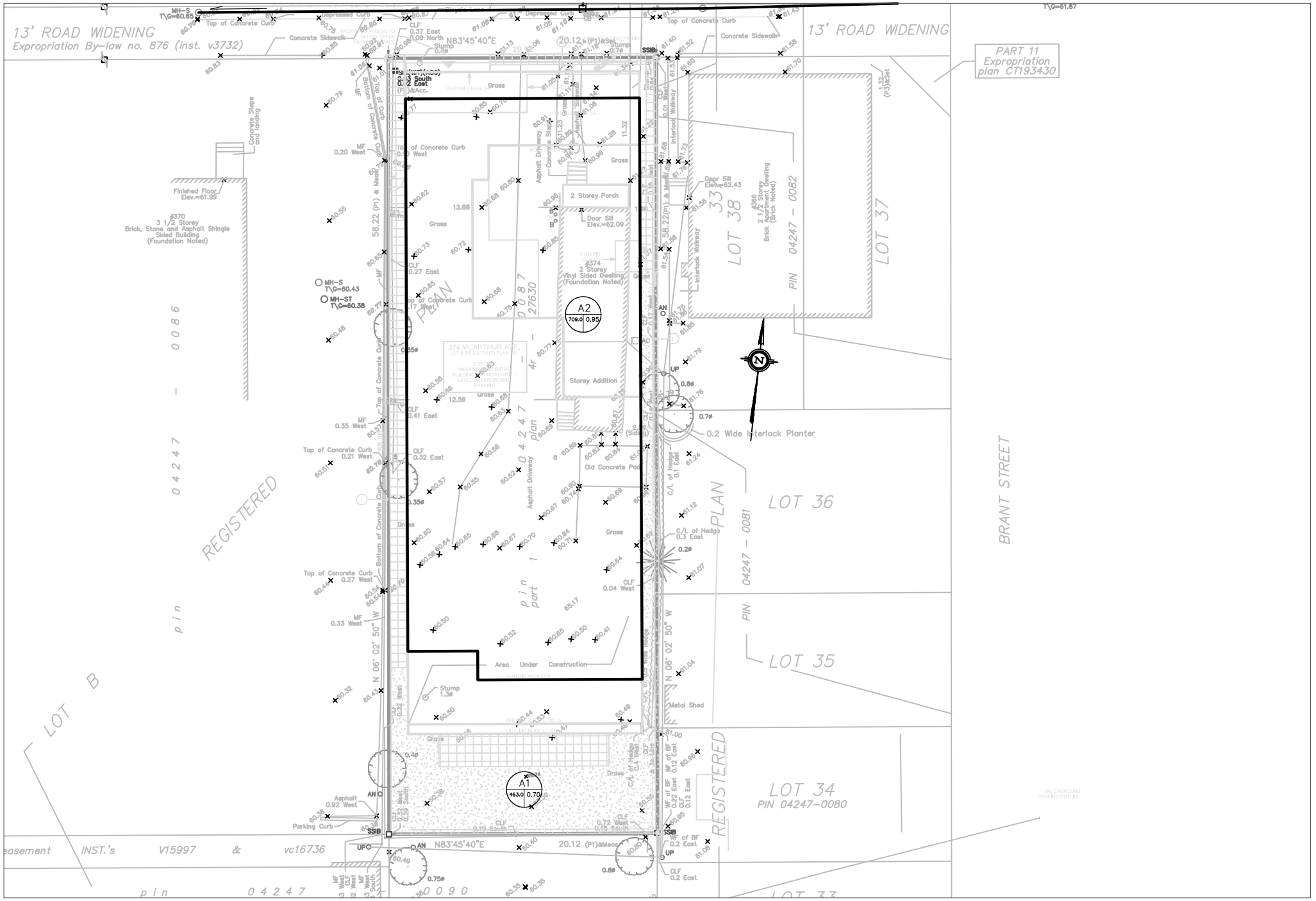


374 McARTHUR AVE., OTTAWA
SWM PREDEVELOPMENT

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-702-3403 contact@archnova.ca



374 McARTHUR AVE., OTTAWA
SWM POSTEVELOPMENT

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-702-3403 contact@archnova.ca

Appendix B: Correspondence

zoran@archnova.ca

From: zoran@archnova.ca
Sent: June 3, 2020 12:31 PM
To: zoran@archnova.ca
Subject: FW: 374 McArthur
Attachments: HGL_2yr_5yr.png

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: June 1, 2020 9:36 AM
To: zoran@archnova.ca
Cc: Paul Robinson <probinson@probinsonconsulting.com>; Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>
Subject: RE: 374 McArthur

Good morning Mr. Mrdja.

Please find provided information from our WRD for your use and resources in regard to this site:

Although we don't usually give out remaining capacity info and committed capacity because of the complexity of the system in the downtown core, because of how it be mis-interpreted (dry weather vs wet weather) and also because this information is always in flux. We usually check the impact of the proposed development in the model with respect to flooding issues and then simply let them know if development can proceed.

Further to above, please find the 2 and 5-year HGL downstream of the site to the outfall. It appears direction as a "2 year" release rate would be appropriate. (see attached).

Please also see below the previously provided information as well.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

Development Review Central Branch | Direction de l'examen des projets d'aménagement, Centrale
Planning, Infrastructure and Economic Development Department | Direction générale de la planification de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1

(613) 580 2424 Ext. | Poste 33017
Int. Mail Code | Code de Courrier Interne 01-14
shawn.wessel@ottawa.ca

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*****Please note that, while my work hours may be affected by the current situation, I still have access to email, video conferencing and telephone. Feel free to schedule video conferences and/or telephone calls, as necessary.*****

From: Wessel, Shawn
Sent: May 13, 2020 11:41 AM
To: zoran@archnova.ca
Cc: Paul Robinson <probinson@probinsonconsulting.com>; Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>
Subject: RE: 374 McArthur

Good morning again Mr. Mrdja.

After consulting with Mr. Tousignant again and in regards to SWM, it has been determined that due to the size of your site and with the proposed building occupying the majority of the site, you are to control the roof to 2 year event and allow surrounding property to drain overland to the ROW. Furthermore, we understand that draining the rear site to the ROW would likely require a rear yard CB (CB lead min. 200 mm dia. for PVC pipe and standard CB or 250 mm dia. for corrugated rear yard HDPE pipe, as per City Guidelines and Detail Drawings S30 & S31). We understand this area in the rear is quite small and coupled with the difficulty to achieve the required release rate for the site and further to response from Water Resources Dept., we will not concern ourselves with this small amount and you are permitted to focus controls on roof top of building.

Water Resource Dept. comments are as follows:

The City enters the allowable flows into the models if we feel it is required (i.e. if there are flooding issues in the area or if the flow is significant). In this particular case, the proposed guideline flows will not cause an issue.

Note that there is flexibility on the sanitary flows because re-development often leads to more persons per hectare and thus makes it impossible to maintain existing flows. On the storm system however, we do not have such leeway and therefore impose SWM due to an increase in imperviousness. The storm system in the core of the City was designed with a 1960's 2 year IDF curve, which is less than today's 2 year IDF curve, making the system undersized by today's standard. Our guidelines seek to create capacity and/or alleviate existing surcharge issues in the system when re-development occurs. This is why we in impose SWM on properties where none existed before.

Please note though, that in some cases the lot is so small that some flexibility must be allowed. In the case of 374 McArthur, the 0.11 ha property would have release rate of only 11 L/s, which can be considered low and difficult to achieve.

I hope this clarifies your inquiries and concerns and please note that we review each site on a “case-by-case” basis and due to the constraints for this particular site, we are providing some flexibility in the SWM criteria.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d’infrastructures

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110 Laurier Ave. W. | 110, avenue Laurier Ouest, Ottawa ON K1P 1J1
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shawn.wessel@ottawa.ca

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From: zoran@archnova.ca <zoran@archnova.ca>
Sent: May 12, 2020 9:00 PM
To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Cc: Paul Robinson <probinson@probinsonconsulting.com>; Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>
Subject: RE: 374 McArthur

This is still good if they can run our input (boundary conditions) for sewer and storm sewer in the model then. We need to have limits established so we know what building size can be supported by the infrastructure. It is a critical information and can lead the entire design in different direction.

Regards,

ZM

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: May 12, 2020 5:09 PM
To: zoran@archnova.ca
Subject: RE: 374 McArthur

Good evening Mr. Mrdja.

The response from our Water Resource and Asset Mgmt. Depts., including Mr. Eric Tousignant, P.Eng. and Mr. Hiran Sandanayake, P.Eng., in regard to your request, is as follows:

Asset Management does not give out remaining and/or committed capacity information because of the complexity of the system in the downtown core (free flow capacity vs surcharged capacity) and because this information is always in flux.
We usually check the impact of the proposed development in the model with respect to flooding issues and then simply let the proponent know if development can proceed with the proposed flows.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

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shawn.wessel@ottawa.ca

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From: zoran@archnova.ca <zoran@archnova.ca>
Sent: May 12, 2020 12:54 PM
To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Subject: RE: 374 McArthur

Thank you,

ZM

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: May 12, 2020 12:48 PM
To: zoran@archnova.ca
Cc: Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>; 'Paul Robinson' <probinson@probinsonconsulting.com>
Subject: RE: 374 McArthur

Thank you for your email and inquiry Mr. Mrdja.

I have passed on your request for information to Water Resources Dept. for a response and will get back to you once I hear from them.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
Gestionnaire de projet – Approbation des demandes d'infrastructures

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shawn.wessel@ottawa.ca

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From: zoran@archnova.ca <zoran@archnova.ca>
Sent: May 12, 2020 12:20 PM
To: Wessel, Shawn <shawn.wessel@ottawa.ca>
Cc: Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>; 'Paul Robinson' <probinson@probinsonconsulting.com>
Subject: RE: 374 McArthur

Thank you for the information. For SWM and sanitary sewer we would need to know what is residual capacity in the system as well as what would be committed capacity. I believe Hiran Sandanayake can help with his model output.

Regards,

Zoran

From: Wessel, Shawn <shawn.wessel@ottawa.ca>
Sent: May 11, 2020 5:20 PM
To: Zoran Mrdja <zoran@archnova.ca>
Cc: Renaud, Jean-Charles <Jean-Charles.Renaud@ottawa.ca>; Paul Robinson <probinson@probinsonconsulting.com>
Subject: 374 McArthur

Good afternoon Mr. Mrdja.

Please find boundary conditions for this site.

The following are boundary conditions, HGL, for hydraulic analysis at 374 McArthur (zone 1W) assumed to be connected to the 406mm on McArthur (see attached PDF for location).

Minimum HGL = 107.8m

Maximum HGL = 118.5m. *The maximum pressure is estimated to be more than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.*

MaxDay + FireFlow (383L/s) = 108.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual

field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

For SWM, I have been told that this system is tight (capacity) and to control to the lesser of C=0.5 or existing for a 2 year event.

If you require additional information or clarification, please do not hesitate to contact me anytime.

Thank you

Regards,

Shawn Wessel, A.Sc.T.,rcji
Project Manager - Infrastructure Approvals
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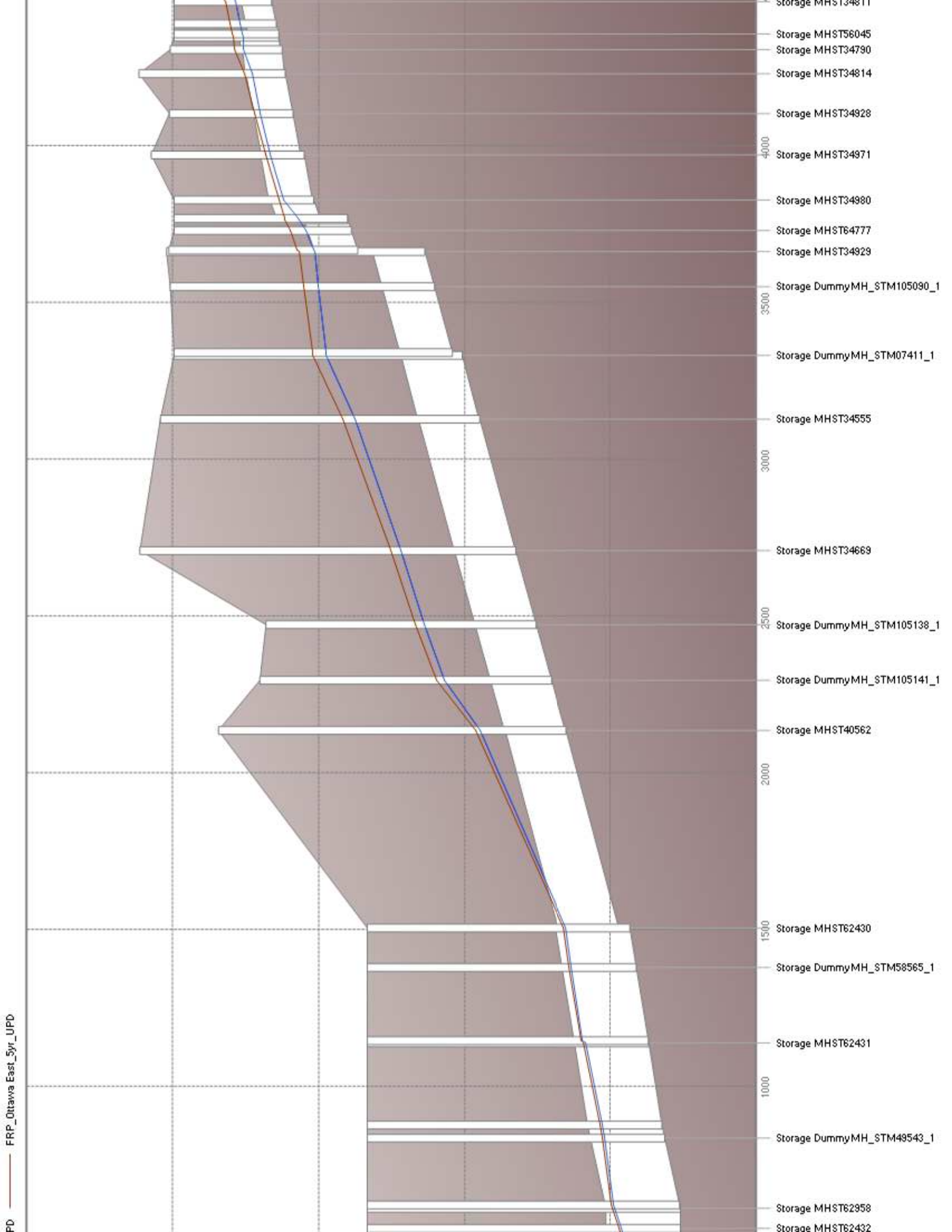
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